1   WHAT IS CLAIMED IS:

2   1.   A hyperbranched polymeric compound having:

3   (1) a polymer backbone portion that is at least partly randomly branched;

4   (2) at least one pendant arm extending from said polymer backbone; and

5   (3) at least one halogen substituted alcohol or phenol group substituted at the pendant group(s) of

6   the polymer backbone portion.

7

8   2.   The compound of claim 1 wherein said compound has the general formula:
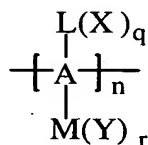
9

10

11

$$\begin{array}{c} L(X)_q \\ | \\ +A+_n \\ | \\ M(Y)_r \end{array}$$

12

13

14   wherein A is the hyperbranched backbone portion of the polymer;

15   L and M are independently selected pendant groups of the polymer backbone;

16   X and Y are independently selected halogen substituted alcohol or phenol groups;

17   q and r are independently selected and at least 1; and

18   n is at least 3.

19

20   3.   The compound of claim 2 wherein A is composed of units selected from the group consisting of silicon

21   atoms, carbon atoms, siloxane, carbosilane, silylene moieties, and combinations thereof.

22

23   4.   The compound of claim 2 wherein A is composed of units selected from the group consisting of Si-

24   alkylene, Si-arylene, and Si-alkenylene units.

25

26   5.   The compound of claim 2 wherein L and M are independently selected from the group consisting of

27   -alkylene-Si-(alkenylene)$_3$ and -alkylene-Si-(alkylene-arylene)$_3$.

28

29   6.   The compound of claim 2 wherein:

30   A is selected from the group consisting of -Si-(CH$_2$)$_n$-, where n=1-3;-Si-(CH(CH$_2$C$_6$H$_5$))-;and

31   -Si-(CH$_2$(C=CH$_2$)CH$_2$)-;

32   L and M are independently selected allyl or propylenephenylene groups; and

33   X and Y are hexafluoroisopropanol groups.

34

35   7.   A solution for preparing a chemical vapor sensor comprising:

36   (a) an amount of a hyperbranched compound having

37   (1) a polymer backbone portion that is at least partly randomly branched;

38   (2) at least one pendant group extending from the polymer backbone portion;

(3) at least one halogen substituted alcohol or phenol group substituted at the pendant group(s) of the polymer backbone portion;

effective to enhance the sensitivity of the sensor to hydrogen bond accepting vapors or nitroaromatic compounds; and

(b) a solvent for said hyperbranched compound.

8.   The solution of claim 7 wherein said compound has the general formula:
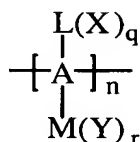
$$\begin{array}{c} L(X)_q \\ | \\ +A+_n \\ | \\ M(Y)_r \end{array}$$

wherein A is the hyperbranched backbone portion of the polymer;

L and M are independently selected pendant groups of said polymer backbone;

X and Y are independently selected halogen substituted alcohol or phenol groups;

q and r are at least 1 and independently selected; and

n is at least 3.

9.   The solution of claim 8 wherein A is composed of units selected from the group consisting of silicon atoms, carbon atoms, siloxane, carbosilane, silylene moieties, and combinations thereof.

10.   The solution of claim 8 wherein A is composed of units selected from the group consisting of Si-alkylene, Si-arylene, and -Si-alkenylene.

11.   The solution of claim 8 wherein:

A is selected from the group consisting of $-Si-(CH_2)_n-$, where $n=1-3$; $-Si-(CH(CH_2C_6H_5))-$; and $-Si-(CH_2(C=CH_2)CH_2)-$;

L and M are independently selected allyl or propylenephenylene groups; and

X and Y are hexafluoroisopropanol groups.

12.   The solution of claim 8 wherein L and M are independently selected from the group consisting of -alkylene-Si-(alkenylene)$_3$ and -alkylene-Si-(alkylene-arylene)$_3$.

13.   The solution of claim 7 wherein said solvent is selected from the group consisting of hexane, chloroform, dichloromethane, toluene, xylenes, acetonitrile and tetrahydrofuran.

14. ✓ A device for selective molecular recognition, said device comprising a sensing portion, wherein said sensing portion includes a substrate having coated thereon a layer, said layer comprising a hyperbranched compound having:

    (1) a polymer backbone portion that is at least partly randomly branched;

    (2) at least one pendant group extending from the backbone portion; and

    (3) at least one halogen substituted alcohol or phenol group substituted at the pendant group(s) of the polymer backbone.

15.   The device of claim 14 wherein said substrate is a surface acoustic wave (SAW) substrate.

16.   The device of claim 14 wherein said compound has the general formula:
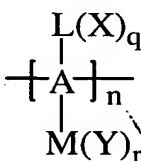
$$\left[\begin{array}{c} L(X)_q \\ | \\ A \\ | \\ M(Y)_r \end{array}\right]_n$$

wherein A is the hyperbranched backbone portion of the polymer;

    L and M are independently selected pendant groups of said polymer backbone;

    X and Y are independently selected halogen substituted alcohol or phenol groups;

    q and r are at least 1 and independently selected; and

    n is at least 3.

17.   The device of claim 16 wherein A is composed of units selected from the group consisting of silicon atoms, carbon atoms, siloxane, carbosilane, silylene moieties, or a combination thereof.

18.   The device of claim 16 wherein A is composed of units selected from the group consisting of Si-alkylene, Si-arylene, and -Si-alkenylene.

19.   The device of claim 16 wherein:

    A is selected from the group consisting of $-Si-(CH_2)_n-$, where $n=1-3$;-$Si-(CH(CH_2C_6H_5))$-;and

      $-Si-(CH_2(C=CH_2)CH_2)-$;

    L and M are independently selected allyl or propylenephenylene groups; and

    X and Y are hexafluoroisopropanol groups.

20. The device of claim 16 wherein L and M are independently selected from the group consisting of -alkylene-Si-(alkenylene)$_3$ and -alkylene-Si-(alkylene-arylene)$_3$.

21. The device of claim 14 wherein said layer is deposited on said substrate by a laser-based coating technique.

22. A method of detecting the molecules of a hydrogen bond accepting vapor comprising the steps of:

   (a) contacting the molecules of said vapor with a device comprising a sensing portion, wherein said sensing portion includes a substrate having coated thereon a layer, said layer comprising a hyperbranched compound having:

   (1) a polymer backbone portion that is at least partly randomly branched;

   (2) at least one pendant group extending from the polymer backbone portion; and
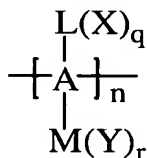
   (3) at least one halogen substituted alcohol or phenol group substituted at the pendant group(s) of the polymer backbone portion.

   (b) collecting said molecules on said layer, wherein said molecules alter a specific physical property of said layer; and

   (c) detecting the amount of change in said physical property from before said contacting step (a) and after said collecting step (b).

23. The method of claim 22 wherein said substrate is a surface acoustic wave (SAW) substrate.

24. The method of claim 22 wherein said compound has the general formula:

$$\left[\begin{array}{c} L(X)_q \\ | \\ A \\ | \\ M(Y)_r \end{array}\right]_n$$

wherein A is the hyperbranched backbone portion of the polymer;

   L and M are independently selected pendant groups of said polymer backbone;

   X and Y are independently selected halogen substituted alcohol or phenol groups;

   q and r are at least 1 and independently selected; and

   n is at least 3.

25. The method of claim 24 wherein A is composed of units selected from the group consisting of silicon atoms, carbon atoms, siloxane, carbosilane, silylene moieties, and combinations thereof.

26. The method of claim 24 wherein A is composed of units selected from the group consisting of Si-alkylene, Si-arylene, or -Si-alkenylene.

1   27.   The method of claim 24 wherein:

2   A is selected from the group consisting of $-Si-(CH_2)_n-$, where $n=1-3$; $-Si-(CH(CH_2C_6H_5))-$; and

3          $-Si-(CH_2(C=CH_2)CH_2)-$;

4   L and M are independently selected allyl or propylenephenylene groups; and

5   X and Y are hexafluoroisopropanol groups.

6

7   28.   The device of claim 24 wherein L and M are independently selected from the group consisting of

8   -alkylene-Si-(alkenylene)$_3$ and -alkylene-Si-(alkylene-arylene)$_3$.

9

10

11

12

13

14